The Chemical Age

A Weekly Journal Devoted to Industrial and Engineering Chemistry

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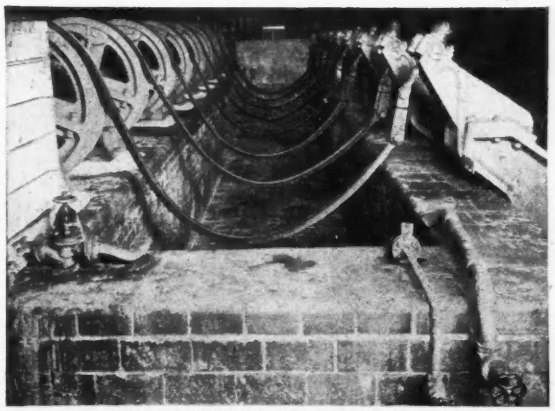

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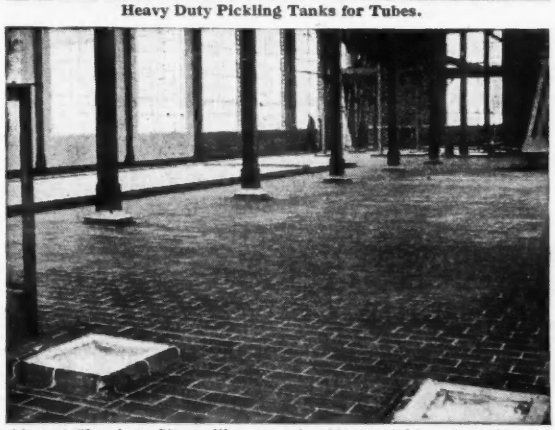

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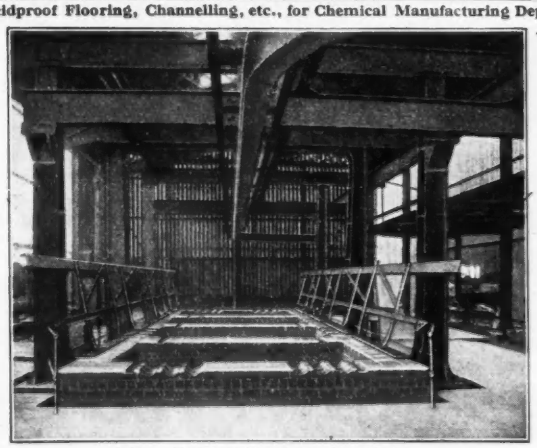

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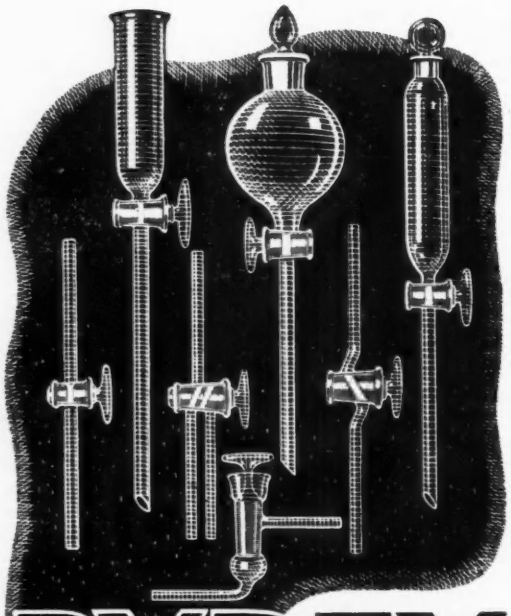

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The Chemical Age

A Weekly Journal Devoted to Industrial and Engineering Chemistry

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Export Trade

THE chemical industry has always been peculiarly interested in foreign trade; there are so many raw materials required by the industry that must be secured from abroad and these materials can only be obtained by the expenditure of money. In order that this expenditure shall be possible it is necessary for the country to export goods or services to the required extent. Already before the war the trade balance of this country was causing misgivings. The annual gap between the visible imports and exports had risen to more than £400,000,000. Although the gap was filled by services such as shipping and finance rendered to overseas countries, and by revenue from overseas investments, there still remained an adverse balance which was made up by the obviously unsound method of the sale of some £50,000,000 a year of investments and overseas assets. It is obvious that after the war some of these methods will no longer be open to us and the potential value of others will have diminished. Serious thought, therefore, should be given now to the problems of export trade after the war.

There has been the welcome announcement that the Board of Trade has appointed a representative committee of industrialists to prepare the future development of British export trade. This committee has a great deal of very serious work to do and we are sure that it will not take its duties lightly. As we have pointed out on previous occasions the world as a whole requires an increased standard of living if trade is to flow freely and employment is to be general. It is therefore undesirable that war-time austerity should continue after the war because our means have diminished; yet we shall find it difficult to purchase from overseas the luxuries to which we have been accustomed if we have not the wherewithal to pay for them. The money to pay for imports must be obtained by exports. No country derives, or probably ever has derived, so large a proportion of its wealth directly or indirectly from overseas trade. No major country depends to so large an extent on overseas trade for the maintenance of a dense population and a high standard of living.

There are certain things which we can do that we have left undone in the past. Our leading industrialists and their senior staffs must make more journeys abroad to meet potential customers face to face, to study their needs and wishes, and to discover what is required for overseas markets. Our engineers and chemists must be set to work to manufacture the goods required, using as far as possible our own resources of raw materials and machinery. We must study how to build up an export trade on those materials which require the greatest possible skill and the greatest amount of labour in this country; the easy way of exporting our best coals to foreign countries, for example, must be abjured. We must take every possible step to improve the quality of our goods and to cheapen our manufacturing costs. This may involve the more ready scrapping of plant and the undertaking of great civil engineering works to facilitate transport, to use water power and to make cheaper fuel more easily available all over the country. It is true that by taking in each other's washing we shall never become richer, but it is also true that we can take in each others washing without becoming one whit poorer. It is, in short, a good policy to encourage every type of productive enterprise even by the use of public funds so long as they are based on our own resources and our own labour; that is one lesson we have learnt from the totalitarian powers. If, for example, we can cheapen our transport materially by constructing a huge network of canals there is no economic reason why we should not do so.

We must make an increasing application of science to enlarge the potential boundaries of our trade horizon. The days when we could maintain our export trade by the simple operation of our staple industries have passed. We must now look to new industries and to new developments in the older industries to provide us with the means for increasing our manufactures of goods that the foreigner cannot produce for himself. The development of the research associations has been an expression of the need for whole industries to collaborate to this end and, valuable as the results have been, we believe that they will be even more valuable in the future. The day has passed when individual firms can prove self-sufficient; there must be co-operation both between all the firms in each industry and between different industries. The inception of export groups, brought about only by a major war, is a more recent manifestation of this idea.

The 19th century economic prosperity was achieved because there was a progressive expansion of domestic and foreign trade throughout the world. In the last century the foundations of expanding trade and prosperity were laid by continuous advances into new territories and by the tapping of new material resources, but in future we must look to scientific discovery to provide us with the means for expansion and to international action to assist in that direction. It has been computed that if the standards of nutrition in the backward countries of the world could be raised to the standards in the more civilised countries, the conditions for progressive expanding prosperity would be recreated. The attainment of this objective after the war will provide us with a worthy task.

On Other Pages

NOTES AND COMMENTS

Coal Control

WITH the creation this week of a Ministry of Fuel, the one raw material which is common to all industries comes into Government control. It is practically impossible to imagine an industry that does not depend on coal in some way or other, and all will be affected by the new measure. Wheatever comes of this step, it will be readily admitted that Major Lloyd George, the new Minister of Fuel, has taken on a tough job; it is obvious that the coal-mining industry is in an unsatisfactory state at the moment. A marked difference between the control of coal and that of other commodities is that coal comes under official management from the very start; its production, not merely its buying or selling, is to be in Government hands. It is early yet to prophesy what sort of a job the new ministry will make of its task; but at least we can wish them luck and a comparatively easy journey along their thorny path. At any rate the Minister is supported by an experienced team: Mr. Tom Smith and Mr. Geoffrey Lloyd as joint Parliamentary Secretaries have a profound knowledge of the intricacies of the fuel maze, and they are certain to face their problem with a true appreciation of its serious nature. An outline of the proposals in hand is contained in the White Paper entitled "Coal" (price 2d.), and these will be carried out by a National Coal Board under the chairmanship of the Minister.

Scarce Substances

INDUSTRIAL chemists know quite enough about shortages of various materials in their own field and are, we hope, well versed in the various Statutory Rules and Orders by which the authorities endeavour to adjust such scarcities so that they shall cause as little inconvenience as possible to those who are working hardest in the national cause. Any substitute materials that they may be obliged to use have been tested by experiment, and often have proved even more suited to certain purposes than the substance they replaced. The Scarce Substances Order, issued recently by the Ministry of Health, however, which affects the drug and pharmaceutical trade, actually lays down a list of "authorised alternatives" for the "scarce substances" covered, and these are to be used for making up prescriptions, unless the letters N.A. (signifying "no alternative") are appended thereto. We are mere rough-and-ready practical chemists and do not pretend to a knowledge of the intricacies of pharmacy or of medical Latin; but some of the "authorised alternatives" do not look very different from simple dilutions, for instance "a mixture of 1 vol. Ext. Nuc. Vom. Liq. and 11 vol. water," as an alternative for Tinct. Nuc. Vom. Seriously, however, it is evident that the pharmacists are running their end of the chemical business under difficult conditions with great efficiency and care, such as is not always exhibited elsewhere. We all know of certain cases where a little "Tinct. Zingib. Fort." might well be prescribed.

A Reconstruction Report

COMPILED at the request of the President of the Board of Trade, the report of the Federation of British Industries, entitled simply "Reconstruction" is a document of great interest, though it claims to be considered only as a preliminary report. Despite this modest attitude, it is evident that a great deal of constructive thought has been employed in the preparation of this useful document. Apart from the fact that it comprises fourteen points, the report has little in common with President Wilson's ill-omened manifesto, no doubt because it has been compiled by practical business men with a knowledge of what ordinary people, as distinct from doctrinaires, really want. The majority of the fourteen submissions of the Federation cover the policy that we, in this journal, have been incessantly advocating, but in some instances they go farther than we have as yet permitted ourselves to do, notably in their recommendation for co-operation with the United States. We particularly welcome a lead in this direction from so authoritative a body as the Federation; the mere fact that the point is raised is an indication that such a policy is well within the range of practical politics. Every industrialist, every worker, who is interested in the future of his trade should make a point of securing a copy of this report. There will be hard times to come, but we need not face them in ignorance.

Another Sort of "Reconstruction"

THE London Chamber of Commerce has issued a report on "General Principles of a Post-War Economy," which reveals the dangerous inroads that the planners have made into what used to be regarded as responsible business circles. The report analyses the economic position in the vague, wordy, and altogether woolly manner familiar to readers of left wing literature. Its triumphant solution of the problems of external trade is the acceptance of the principles laid down in the Economic Reform Club's "A Twentieth Century Economic System," especially in respect of blocked credits for the payment of international obligations. The London Chamber of Commerce, of all bodies, is actually made to declare for the setting up of "appropriate machinery to ensure that slumps may be forestalled through close co-operation between industry and the central bank." This is the very negation of private enterprise and the commercial principles on which British trade supremacy has been built up. It is inconceivable that the firms constituting the London Chamber should commit themselves to the doctrine of a managed currency and in general to bureaucratic interference with the normal flow of trade.

Containers and Storage in the U.S.

ADVICES from America indicate that a shortage of various types of container is likely to develop. Bottles, jars and other glass containers, as well as metal cans and the like, are affected. At one time it was believed that limited supplies of soda ash were likely to cause a glass shortage; but it is now evident that other features will have a much more rapid and serious effect. Rubber, cork, and other scarce materials for the sealing of gaskets are expected to be severely restricted and, for many types of goods, may even be entirely prohibited. Restriction of metal for the closing of packages is also imminent, and although the problem of getting metals is going to be difficult, no matter what kind of container is involved, all divisions of industry are being urged to make as much re-use of metals as is possible. At the same time the problem of storage likewise raises its head. Transport irregularities and uncertainties of demand are the prime causes here, but with reasonable foresight and wise planning on the part of executives and engineers, the difficulty of securing adequate storage space at the required moment should not be insuperable.

Asbestos Problems

ONE of the typical problems of war-time supply, and one which affects the chemical industry most intimately, is the maintenance of a balance between quality of materal and accessibility of supply. A case in point is provided by asbestos in the United States. Asbestos, fair in quality and quantity, is produced domestically, mainly in the form of short-fibred chrysotile, though a certain amount of the long-fibred variety is quarried in Arizona; but in recent years these domestic supplies have fulfilled only up to 8 per cent. of national requirements, the remainder being imported from Canada—by far the largest proportion—and Africa. Canadian long-fibred chrysotile is of excellent quality and suited to almost all the purposes for which asbestos is required, but the Rhodesian type is notable for its extremely low iron content, a quality that makes it specially valuable in equipment designed for high electrical resistance. Another African type is the blue crocidolite, whose resistance to chemical action is so high that it is unequalled for acid filters and acid-resisting pressure pipes. Shipping difficulties being what they are, the U.S. supply authorities are probably finding it difficult to apportion their demands between the special African qualities and the all-purpose ready-to-hand Canadian brand.

THE POLAROGRAPH, II

Industrial Uses of the Analytical Technique

by DAVID L. MASTERS, M.Sc., Ph.D.

(*Continued from* THE CHEMICAL AGE, *May* 30, 1942, *p.* 272)

THE treatment of the solution to be analysed is naturally of importance. It is usual to prepare it so that, in addition to the unknowns to be determined, it contains a considerable excess of what is known as an "indifferent electrolyte." Concerning this component two important points may be noted. It performs in the first place the desirable function of maintaining an approximately constant concentration in all solutions that are being examined; consequently, one of the variables which might affect analyses is disposed of. The second point of note is that the indifferent electrolyte must be chosen while bearing in mind the substances likely to make up the unknown. Study of the curves will indicate that the half-wave potential of this stock material must necessarily be more negative than those of the constituents of the unknown. Otherwise the waves which have to be measured will be completely obscured.

The quantitative polarographic analysis of a solution may be carried out in a number of ways. It is, of course, possible to calculate all results from first principles.[4] But, apart from its academic interest, and the use which it has in checking procedures which may be open to suspicion, this is an unnecessary labour, and is rarely employed. Two well established practical methods may be detailed here. If it is intended to carry out a large number of routine investigations of a substance such as lead in cadmium, then it is preferable to prepare a series of polarograms with a range of lead concentrations covering all likely to be met with in practice. From this a straight-line relation between wave-height and concentration may be constructed. This enables any experimentally determined wave-height to be converted directly into percentage.

If, on the other hand, a large number of widely different analyses are projected, the preparation of the many calibration charts necessary may be avoided by use of an alternative procedure. The unknown, which is being analysed for, say, zinc, is polarographed. To the solution a known amount of zinc ion is added, altering the concentration by a known value. From the old and new heights of the zinc wave it is easy to calculate the original concentration of the zinc ion in the solution. Thus, if the zinc wave-height is doubled, the concentration has been doubled (Fig. 5).

Application of the Method

The fields to which polarographic analysis has been successfully applied include alloy analysis, the investigation of pigments, ceramics, and rubber, and the determination of natural products and of minor constituents in biological material. Probably the best method of demonstrating the application and advantages of the technique is through consideration of several problems that have received atttention.

Wide variation has been shown in the ingenious treatment of cases where several metallic ions which normally interfere are concerned. Two ways of surmounting the difficulty may be mentioned. Small amounts of copper which are difficult to determine in the presence of much iron are first subjected to a preliminary separation.[5] It is sometimes only necessary to precipitate the iron as hydroxide, allow the precipitate to settle, and then remove the copper solution by pipette. Since the polarograph measures concentrations, and not absolute quantities, it is, of course, only necessary to work with a known aliquot of the solution.

Nickel and cobalt are not distinguished by the polarograph under ordinary conditions, but in a solution containing pyridine sufficient separation is caused, owing to the formation of complexes, to enable extremely small concentrations of nickel in cobalt to be determined[6] A difference in half-wave potentials of 0.1 volt in KCl solution is increased to 0.29 volt in a solution which contains pyridine. Likewise, zinc and nickel have been determined in the same solution, although normally their waves are indistinguishable.[7] With them, a preliminary determination

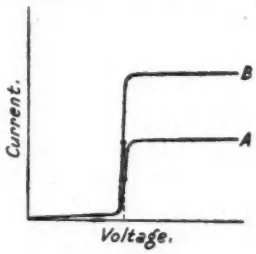

Fig. 5.
A = Original polarogram of solution containing unknown amount of zinc
B = Polarogram after addition of known amount of zinc

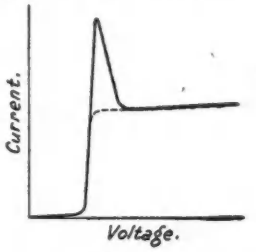

Fig. 6.
Full line = Polarogram actually obtained
Dotted line = Normal curve, and curve obtained after suppression of peak by colloids, etc.

gives the total zinc and nickel content. Addition of cyanide to the solution then suppresses the zinc wave entirely, so that a second determination gives the nickel concentration. From the two results the zinc content is obtained by difference.

Extremely interesting applications of practices which have already been used in spectroscopy are to be found in some work on the determination of very small amounts of lead in biological material.[8] The lead is first concentrated by electrodeposition, a device which was formerly applied in spectrum analysis.[9] Subsequently, a known amount of cadmium is added to the solution containing the concentrate of lead—a development of the well-known "internal standard" method. The resulting polarogram enables the lead concentration to be calculated by reference to the cadmium wave-height.

While the analysis of organic materials is not so far advanced experimentally, mainly because of the more complicated conditions which may attend organic electroreductions, quite a number of compounds have been shown to obey the qualitative and quantitative requirements of the polarograph.[10] Strange to say, it is also feasible to determine by the polarograph certain classes of organic compounds which do not necessarily take part in an oxidation-reduction reaction. This results from a peculiar phenomenon which has not, as yet, been satisfactorily explained. Certain salts, when polarographed, give an unexpected maximum at the half-wave potential, the curve subsequently falling to the height to be expected from the concentration of the salt (Fig. 6). Now, it has been found that additions of small amounts of certain colloidal materials or certain dyes reduces or suppresses this maximum, so that a normal curve may be obtained. The importance of this lies in the fact that the degree of suppression is directly proportional to the concentration of the suppressing agent. It is therefore possible to estimate, say, starch, by recording the extent to which a cobalt maximum is suppressed.

Advantages of the Technique

Earlier in this article a number of obstacles to the widest application of polarographic analysis were detailed. It would be unfair to conclude, therefore, without specific mention of the more important advantages to be derived from its use. The paramount saving is in the matter of

time. Fifteen minutes may suffice in favourable cases for a complete alloy analysis. In addition, a permanent record of the analysis may be filed for constant reference or checking. It is often important, too, that the solution under analysis should be essentially unaltered by the process of analysis. The electrolysis which takes place, in ordinary work, is so slight as to be negligible, and may only make its effect felt when the method is applied to the micro-polarography of trace elements.

The accuracy is approximately equivalent to that of micro-gravimetric analysis, except in special circumstances; so that a trace element may well be determined with an accuracy of ± 1 per cent. The amount required for an analysis is also small, since the usual quantity of solution employed varies from 5 to 20 ml., and the best results are obtained when the concentration lies in the range 10^{-5} to 10^{-3} molar. These limits may with care be extended considerably, and micro-polarography has been shown to be capable of dealing with less than 1/200 ml. of solution, and with amounts of the order of 1μg.

A recent article[11] discusses at some length the general precautions that must be observed in order to attain the maximum degree of accuracy in quantitative analysis with the polarograph. Certain points, such as the dropping rate of, and the pressure on the mercury from the polarisable electrode, solvent, and temperature, will require attention, whether a single substance is being dealt with or a mixture. The analysis of a solution containing a mixture raises a number of fresh problems. For example, the reduction of one of the constituents may result in the formation of a compound which will react with another constituent. Consequently it will be impossible to obtain a true analysis directly. Again, the appearance of maxima of the type shown in Fig. 6 is not necessarily troublesome in simple solutions. But it may prevent the operator from obtaining correct figures for the concentrations of several components in a mixed solution. The wave due to the constituent which is first reduced may not have time to fall to a constant diffusion current value before the curve enters on the second maximum, therefore the concentration of the first reduced substance, as determined from the polarogram, will be too high. In such a case it is well to suppress the maxima completely by the addition of a suitable colloid.

While it is possible to generalise in this fashion, it must be emphasised that it is usually impossible to predict from *prima facie* evidence the feasibility of any particular analysis. The only sure test consists in a practical investigation of systems of the type with which it is proposed to deal. Up to the present time the majority of the published work has dealt with the topic more from theoretical aspects, and it is now left to those analytical chemists who have the opportunity and courage to investigate a new method to make corresponding advances in the application of the polarograph to industrial problems.

In conclusion it is interesting to speculate on the advantages of combining polarography with the use of the spectrograph. In the region where polarography is weakest — the qualitative examination of unknowns—the spectrograph has its widest application. However, the technique required for quantitative analysis spectrographically is admittedly beyond the resources of many laboratories. It would appear that a preliminary spectrographic examination might well indicate subsequent treatment which would bring the unknown into a suitable condition for polarographic analysis. In this way the advantages of both methods might be united to form a much more powerful approach than that afforded by either of the two techniques unsupported.

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1 For much fuller discussions of the history, theory and development of the polarograph the reader is referred to the following: KOLTHOFF and LINGANE, "Polarography," New York (1941); HOHN, "Anleitung für die Chemische Laboratoriumspraxis, Bd. III, Chemische Analysen mit dem Polarographen," Berlin (1937); KOLTHOFF and LINGANE, *Chem. Revs.*, 1939, *24*, 1. MÜLLER, *J. Chem. Ed.*, 1941, *18*, 65, 111, 172, 227, 320. COATES and STUART, *Chem. and Ind.*, 1941, *60*, 778. MÜLLER, *Ind. Eng. Chem.* (*Anal.*), 1942, *14*, 99. KOLTHOFF, *Ind. Eng. Chem.* (*Anal.*), 1942, *14*, 195.

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Chemicals in Italy

Montecatini Annual Report for 1941

MONTECATINI, Italy's chemical and metallurgical combine, reports for 1941 an intensification of operations, especially in the direction of metals and synthetic fibres. The number of factories rose to 225, no less than 58 of which are concerned with the manufacture of phosphatic fertilisers. Nitrogen compounds are made in eight plants in sufficient quantities for agricultural and war needs; a 20,000-ton plant is not working owing to shortage of coal. About 30 mines are operated by Montecatini and produce pyrites, sulphur, copper, zinc, lead, bauxite, fluorite, barytes, marble, and lignite; about 24 works are concerned with the utilisation of mining products. Good progress is reported for fine zinc and alloys, and the production of cobalt and manganese ore is to start shortly. The alumina plant was extended, a new aluminium factory is under construction, and a plant for synthetic cryolite was opened.

Industrial chemicals are manufactured in 25 factories; some of these profited from improved exports, and most of them had to change over to war production. Shortage of copper led to experiments with new insecticides. The aniline dyes factory (in which I.G. holds a 49 per cent. interest) was able to increase its output, mostly of cheaper grades of dyestuffs. No details are given about the 25 paint, lacquer and explosives factories, the eight glue and adhesive works, and the three plastics plants, but it is stated that two factories for the production of nylon were completed, although the machinery ordered in U.S.A. was not received. Rhodiaceta Italiana, a Montecatini subsidiary, considerably increased its output of cell-wool, cellulose acetate, and plastics.

The total number of workers increased from 78,500 to 81,000, and the consumption of electric power by 15 per cent. to 2140 million kWh, about one-tenth of the total electric power production in Italy. The gross profit rose in 1941 from 342.10 to 409.03, and the net profit from 160.84 to 175.72 million lire. The dividend is maintained at 10 per cent. for the increased capital of 1600 (1300) million lire which has been raised since to 2000.

POWDER METALLURGY DEFINED

In view of the growing industrial importance of powder metallurgy, from both the scientific and commercial points of view (*see* THE CHEMICAL AGE, *44*, 1140, p. 255) the American Society for Metals has issued a glossary of some hundred terms used in connection with powdered metals. "Powder Metallurgy" is defined as "the art of producing metal powders and shaped objects from individual, mixed, or alloyed metal powders, with or without the inclusion of non-metallic constituents, by pressing or forming objects which are simultaneously or subsequently heated to produce a coalesced, sintered, alloyed, brazed, or welded mass, characterised by the absence of fusion, or the fusion of a minor component only."

Personal Notes

MR. H. C. GREEN and MR. F. F. MANNOX have been appointed joint general managers of Murex, Ltd.

MR. MALCOLM DUNBAR, managing director of L. Oertling, Ltd., balance manufacturers, has been elected vice-president of the Rotary Club of London, of which he has been a member since 1919.

MR. E. J. FOX, managing director of the Stanton Ironworks Co., Ltd., for the past 25 years, is resigning from the board on June 30. Mr. Fox remains a director of Stewarts and Lloyds, Ltd.

MR. H. J. RODDA, B.Sc., Adelaide University, has been awarded the Masson Memorial Scholarship (founded in memory of Sir David Masson) by the Australian Chemical Institute. Mr. Rodda has been acting as demonstrator in practical chemistry at the School of Mines, Adelaide.

At the annual general meeting of the South Yorkshire Section of the Institute of Chemistry, held at Sheffield on May 29, the following elections were confirmed: Chairman, MR. A. H. DODD; vice-chairman on retirement from position as chairman, MR. B. W. METHLEY; newly-elected vice-chairman, MR. E. J. VAUGHAN; members of committee, DR. E. GREGORY (Member of Council), Dr. R. A. MOTT, PROFESSOR R. D. HAWORTH, MR. W. F. ANDREWS, DR. G. LAWTON, MR. R. BELCHER, MR. G. E. SPEIGHT, DR. E. A. J. MAHLER, MR. J. L. WEST, and MR. P. LORD; hon. secretary, MR. G. PARKIN; hon. treasurer, DR. A. W. CHAPMAN; hon. auditor, MR. W. W. STEVENSON.

Sampling of Coal and Coke

New British Standard

SINCE 1930 the British Standards Institution has published methods for the sampling and analysis of coal and coke to suit a variety of industrial requirements. During the preparation of these specifications experimental work has been carried out continuously by members of the committees, both upon the principles of sampling and upon the methods of analysis of the laboratory sample, and it is now considered desirable to review all this work, and to publish two comprehensive specifications embodying only the final terms arrived at. One of these specifications covers the sampling of coal and coke down to the stage of the preparation of the laboratory sample; the other details the treatment of the laboratory samples and gives all the methods of analysis that have been approved after examination by the committees.

In British Specification No. 1016 the weights of the gross samples specified are based on the size of the coal, on its variability, and on the degree of accuracy required of the analysis. The number and size of the increments required are chiefly determined by the variability of the coal, as indicated by the average deviation of the ash content from the mean. Since this deviation increases with increasing ash content, the coals are grouped for sampling purposes according to the amount of ash they contain.

The basis of the method detailed for the sampling of coke is the same as that given for small coal in British Specification No. 403, the moisture content being taken as the determining sampling factor. In the application of this factor, two classes of coke are recognised, and the size of the samples necessary for the desired accuracy is detailed in terms of varying moisture content in each class. These classes are: (1) Screened or unscreened coke containing not more than 7½ per cent. below 1 in. when quenched and not more than 5 per cent. moisture. This class, therefore, includes graded cokes; (2) Other cokes and breeze.

The other Specification (No. 1017) contains all the methods in common use for the analysis and testing of coal and coke. Emphasis is laid on the correct method of determining the moisture content of the gross sample. The specification is divided into three parts. Part I deals with the analysis of coal, Part II with the analysis of coke (including physical tests), and Part III with the analysis of coal ash and coke ash.

Copies of these specifications may be obtained from the British Standards Institution, 28 Victoria Street, S.W.1; price, No. 1016, 5s. 6d., post free; No. 1017, 3s. 10d., post free.

Colouring Cement

Pigments Covered by a British Standard

THE British Standards Institution has just issued a British Standard Specification on Pigments for Colouring Cement, Magnesium Oxychloride, and Concrete (B.S. 1014-1942). This deals with a range of pigments, artificial and natural, suitable for colouring cement mortars or concrete, and magnesium oxychloride compositions. The pigments covered by the specifications provide almost all the colours required, the chief exception being blue.

The committee responsible for the preparation of the Specifications has used the previously published Specifications for pigments for paint, making such modifications to the requirements to suit the particular needs of the concrete and oxychloride flooring industries. For example, in pigments for paint the presence of any significant proportion of coarse particles is objectionable, but in the materials with which the present Specifications are concerned quite a large proportion of relatively coarse particles is tolerable. Again, no objection is raised to the existence of a slight degree of acidity or alkalinity, because both Portland cement and magnesium oxychloride are alkaline substances and slight departure from neutrality will have no harmful effects.

Users are cautioned against incorporating in concrete or oxychloride compositions large proportions of weak pigments. In cases where more than 10 per cent. of pigment (by weight of the cement) is required to produce the desired colour it is desirable to change to a stronger pigment, since excessive proportions of pigments seriously reduce the strength of cements.

It is hoped that the present group of Specifications, as a result of the relaxing of certain requirements, will increase the range of pigments available for colouring oxychloride compositions and concrete products, to the advantage both of pigment manufacturers and users.

All pigments covered by this group of Specifications are believed to be stable in the presence of cement or oxychloride composition, but the committee has been informed of cases in which fading of carbon black pigments has occurred. The committee has not felt itself able to specify a test for performance of carbon black pigments at the present time. Users of pigments are recommended to obtain suitable assurances—additional to the safeguards provided by the Specification—before carrying out any large amount of work with types of carbonaceous black with which they are not familiar.

Copies of this new Standard may be obtained from the Institution, 28 Victoria Street, Westminster, S.W.1, price 2s. 3d. post free.

New Control Orders

Tins, Cans, Kegs, etc.

THE Control of Tins, Cans, Kegs, Drums and Packaging Pails (No. 7) Order, 1942 (S.R. & O., 1942, No. 942, price 2d.), which came into force on May 26, has been made by the Minister of Supply for the purpose of imposing further restrictions on the use of controlled material for containers. The No. 6 Order (*see* THE CHEMICAL AGE, March 28, page 172) is amended by substituting throughout the words "controlled metal or composite container or holder," for "controlled metal container or metal holder," and by prohibiting the use of the controlled materials mentioned in the No. 6 Order for all closures except certain specified types.

A.C.S. Meeting

Papers from the Chemical Engineering and Petroleum Divisions

ONCE again, through the courtesy of the American Chemical Society, we are glad to be able to publish some abstracts of papers presented at the meeting of the Divisions of Petroleum Chemistry and of Industrial and Engineering Chemistry, at Memphis, Tenn., in April.

In the Industrial and Engineering Division, "Preferential Oxidation of Phosphorus in the Presence of Carbon Monoxide," was the subject of the first paper, presented by G. L. Frear, E. F. Ogg, and L. H. Hull, Tennessee Valley Authority, Wilson Dam, Ala. The gases produced in reducing phosphates in a blast furnace or an electric furnace contain both phosphorus and carbon monoxide. It is advantageous to conserve the carbon monoxide for use as fuel, particularly for use in preheating air for the blast furnace. Since the ignition temperature of phosphorus is much lower than that of carbon monoxide, it appeared that the phosphorus could be oxidised preferentially, and the phosphorus pentoxide separated from the carbon monoxide. For gas containing 1 per cent. phosphorus and 39 per cent. carbon monoxide, almost complete oxidation of the phosphorus was accomplished at 500° to 700° C. with about 160 per cent. of the theoretical air requirement for oxidation of the phosphorus to the pentoxide, and about 1 per cent. of the carbon monoxide was oxidised. At 1100° C., preferential oxidation of the phosphorus in this gas was possible in the presence of phosphate rock, with which the P_2O_5 immediately reacted to form calcium metaphosphate. For gas containing 7 per cent. phosphorus and 90 per cent. carbon monoxide, substantially complete oxidation of the phosphorus occurred at 550° to 600° C. with 125 per cent. of the theoretical air requirement, and about 2 per cent. of the carbon monoxide was oxidised. With gases of both compositions, the presence of water vapour increased the oxidation of carbon monoxide, and control of combustion rates was found to be important.

A Centrifugal Contactor

"Decontamination and Dehumidification of Air by Countercurrent Washing in a Centrifugal Contactor" was dealt with by W. J. Podbielniak, Podbielniak Centrifugal Super-Contactor Co., Chicago, who gave a brief report of typical centrifugal fractionator and solvent extractor apparatus constructions and their performance. A preliminary design was submitted of an apparatus for decontaminating air from chemical smokes and contaminants used in warfare by combined centrifuging and countercurrent chemical solution scrubbing action. The general design factors and performance characteristics of the centrifugal contactor were analysed in application to large-capacity low-pressure drop contacting of air with chemical drying solutions with four or more transfer unit effectiveness, as compared with gravitational-type scrubbing towers. The special advantages of the centrifugal contactor were pointed out in effective handling of finely divided solids and in applications requiring compactnesss and use of corrosion resistant metals, saving of material, etc.

Substitute Fuels

In the Division of Petroleum Chemistry, Gustav Egloff and P. M. Van Arsdell, Universal Oil Products Company, Research Laboratories, Chicago, presented a paper on "Substitute Fuels, a War Economy of World Dimension." With the United Nations in the possession of 90 per cent. of the world's oil, the fuel situation for the Axis-controlled nations has involved the use of many substitute motor fuels. Hydrogenation of coal by the Bergius and carbon monoxide by the Fischer-Tropsch process has been responsible for 43 per cent. of the oil used by Germany for war purposes. Compressed gases, alcohol-, wood-, and coal-burning transport, shale, and miscellaneous fuels have not been as important in military usage as the liquid fuels, but are used exclusively by the civilian population. At the end of 1941 it was estimated that there was a total of 107,225 compressed-gas vehicles which released approximately 2,553,000 barrels of liquid fuels, and a maximum of 373,143 producer-gas vehicles in use in Europe, which saved about 7,780,000 barrels of oil fuels. Approximately 13,200,000 barrels of benzol and alcohol were produced on the European continent in the same period and 233,000 barrels of shale oil also had been produced.

"Influence of Sulphur Compounds on Octane Number and Lead Susceptibility of Gasolines," was the title of the paper presented by Julian G. Ryan, Shell Oil Company, Wood River, Ill. Antiknock characteristics of gasolines are impaired by the presence of sulphur compounds to an extent dependent upon hydrocarbon structure and sulphur type. Susceptibility to tetraethyl lead as affected by structure of sulphur compounds has been investigated quantitatively. A relation which is independent of hydrocarbon composition has been established between concentration of various sulphur types and lead susceptibility. This mathematical expression permits accurate evaluation from group sulphur analyses of the improvement obtainable by partial or complete desulphurisation, the effect of sweetening methods, and the effect of blending stocks of similar hydrocarbon composition but different sulphur contents. The effect of sulphur compounds upon octane number in the absence of tetraethyl lead varies with size and structure of the hydrocarbon portion of the molecule as well as the sulphur type.

Oxidation of Lubricating Oils

A paper on "Oxidation Characteristics of Lubricating Oils: the Relation between Stability and Chemical Composition," was presented by G. H. von Fuchs and H. Diamond, Shell Oil Company, Inc., Wood River, Ill. Analysis of rate curves obtained by measurement of oxygen absorption has elucidated the effect of basic composition, methods of processing, and addition agents on the stability of oils. Oxidation characteristics are strongly influenced by interaction between different types of component. Saturated hydrocarbons in an oil have a tendency to rapid autocatalytic oxidation, whereas aromatic compounds act as antioxidants by a mechanism of auto-retardation. The balance between these opposing effects is strongly dependent on the reaction temperature. Under given conditions of temperature and metal catalysis maximum stability is observed at an intermediate (optimum) aromaticity. Auto-retardation differs from the action of conventional inhibitors. Reactions involved in the formation of saponifiable material (free, combined, and potential acids) may account for most of the oxygen absorbed by an oil. Results can be correlated with oil deterioration and lacquer deposition in engine tests.

Determination of Olefines in Hydrocarbons

B. R. Stanerson and Harry Levin, the Texas Company, Beacon, N.Y., presented a paper on a method for determining olefine content of C_3 and C_4 hydrocarbons by direct titration of sample condensed in cold chloroform. Bromine in glacial acetic acid is used for titration. The method has given satisfactory results on synthetic blends covering the complete range of unsaturation and is particularly suited for routine plant control purposes because of its simplicity and rapidity. Hydrogen sulphide, mercaptans, and 1,3-butadiene must be removed before analysis.

"Molecular Weights of Viscous Hydrocarbon Oils," presented by Alfred E. Hirschler, was the title of the next paper to be read. Molecular weights of lubricant fractions have been correlated with kinematic viscosities at 100° and 210° F., using a modified Keith and Roess chart, and with densities at 25° C. and the 210° F. viscosities. By combining these two charts a correlation between these four physical constants is developed whereby any two many be used to estimate values of the other two. Based on this chart, a simple equation has been developed for calculating the molecular weight from viscosity data, applicable to oils with viscosity indices between 50 and 140.

Metallurgical Section

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Recovery of Copper from Poor Residues

Improved Rotary Process

by A. G. AREND

RECOVERY of copper from exceedingly poor residues, containing 1 per cent. or less of the metal, was for long fraught with the greatest practical and economic difficulties. It may be recalled that during the last war numerous small metal-refining firms came into existence which dealt with the preparation of different alloys for armament purposes, but which after the war were compelled to abandon their activities. One of the many reasons for this was that much had depended upon the high market price of copper, and the plant lay-out was an economic success only so long as this price was maintained.

A frequent source of poor residues was the material obtained from brass-founders, brass-finishers, smelting firms, etc. The raw materials comprised buffings, scrapings, and slags, while accumulated foundry sands containing the metal represented an even poorer grade, sometimes not containing even 1 per cent. of metallic copper. The usual practice was first to crush the mass in a grinding mill, then to pass it with water through a set of jigs, as in mining enterprises; after this the material was passed over a concentrating table, and finally run through a magnetic machine to remove accumulated iron. The concentrated mass so obtained still contained much in the way of sand particles, and necessitated a pyro-refining treatment in any case. In one district, after the last war, so desperate did the conditions become because of the large amount of work expended for so small a reward, that certain of the smaller refiners were known to acquire the waste residues without making payment until after the reclamation had been completed.

In many instances at that time the collected residues were not even analysed, and the process was worked chiefly to keep the personnel on hand, since little could be looked for in the way of profit. Conditions were improved in one works in this country by attempting the continental style of smelting all such waste materials directly. Success, however, largely depended upon acquiring an appropriate proportion of poor brass or copper slags, and if these were not forthcoming, the process was temporarily held up.

Impoverished Tin Content

The principles involved were that all foundry wastes, brass ashes, coppersmiths' wastes, etc., were first ground and mixed together with pulverised slags, and smelted with the smallest permissible amount of pyrites. The resulting products formed a matte, rarely containing more than 25 per cent. of copper, and anything from 3 to 10 per cent. of lead, but the tin content was impoverished by the sulphurising treatment, and seldom exceeded 1 per cent. and more frequently ranged from 0.1 to 0.2 per cent. No allowance was thus made for tin present in the residues, but the process was not intended for gun-metal or bronze wastes, and was related specifically to the different brass wastes, which were understood to be free from tin.

Half of this matte was roasted so as to convert it to oxides of the metals contained, then mixed with the remaining half of unroasted matte, and smelted in lengthy coal-fired reverberatory furnaces. The crude copper alloy recovered, however, was good material as a base for the preparation of all kinds of regular brasses, gun-metals, etc. A further process consisted of smelting the matte in an improvised blast-furnace, instead of the reverberatory hearth. In the initial smelting, the slag was understood not to contain more than about 0.1 per cent. of copper. The amount of fuel expended in liquefying such a vast bulk of material can be understood, and was justifiable only when the market price of copper ranged from £100 to £120 per ton. The second part of the process did not differ from existing practice at the time. A minimum of 1000 tons was claimed to be treated weekly, but after the last war the factory was closed down.

The Continuous Rotary System

Improved continental methods in the intervening years have revealed the tendency towards continuous working, making as much use of the rotary process as possible, while instead of allowing the valuable tin content to be dissipated, every effort is made to reclaim it completely by the electrostatic system.

Tin, and also antimony, are rendered volatile by the presence of sulphur, and there were many critics of the system until adaptations of the electrostatic process proved that the recovery of these metals was almost absolute. The rotary process involves a principle which was only found as a result of somewhat intensive research during working on other similar treatment of ores and concentrates, and depends largely on the design and construction of the hearths themselves. The apparent weakness of the former process was that unless equivalent proportions of slags and slag-making materials were available, the process could not be worked. With the latest rotary system, no such addition is necessary, and a measure of independence is thus gained, which would not otherwise be obtainable, since almost any class of waste material containing copper can be dealt with directly.

It was found that when ashes and poor residues were mixed with a small proportion of iron pyrites, in roasting furnaces fired with pulverised coal and suitably adapted, the sulphur content of the pyrites could be made to combine with the copper, and other metallic particles present, in such a way that definite molten globules were formed. The continual rotation of the bulky mass offered opportunities for these globules to get together, and as they were of much greater specific gravity than that of the sand, ashes, etc., they eventually gravitated to the bottom section of the cylindrical hearth. Rotary hearths of this kind were used for other purposes, but it was soon revealed that the lengthy sloping cylindrical body was practically ideal for this kind of treatment. The reason is that, although on a shorter type of cylinder the globules of matte formed would not get the same opportunity to agglomerate, the lengthy passage cannot but cause an accumulation at the bottom, and when ultimately the total mass has reached the far end of the hearth, the bottom section contains practically the entire copper content, together with heavier waste material.

Not a little of the success rests upon the method of firing with pulverised coal, since, despite the air-blast required to ensure reliable combustion, the desired reducing conditions are maintained. The burners used are of the turbulent high-pressure type, and a lengthy flame is provided. By dint of taking samples at different stages throughout

the length of the rotary cylinder, it was shown how the sulphur had "picked up" the copper and other base metals, but unless the correct temperature is maintained, the hot globules could become dissipated within the bulky mass of ashes, sand, and the like.

It is needless to minimise the practical features of the process, which are many, since the refractory walls of the rotating hearth must revolve only at a specific speed according to a time/temperature ratio.

When first discussed, it was erroneously contended that at the final stages the accumulated molten matte would be raised from the bottom layers by the movement present, but what happens in practice is that the high temperature of the walls, added to the scraping action of the bulky mass above, ensures that almost the entire matte content is accumulated in one place. The pulverised-coal burners are situated at the opposite end from the charging end, *i.e.*, where the matte accumulates, the temperature is highest. It is known that there is a certain art in preventing any of the loose mass from being polluted at the final stages. As will be understood, slag in any form is highly detrimental, since this would tend to lick the sides of the cylindrical hearth, and undo the process, which is to keep the vast bulk of the mass dry, and to rely on the maintenance throughout of the refractory nature of the foundry sand and ashes.

In order to facilitate simple, direct, and continuous charging, all trucks or waggons of waste are dumped into a

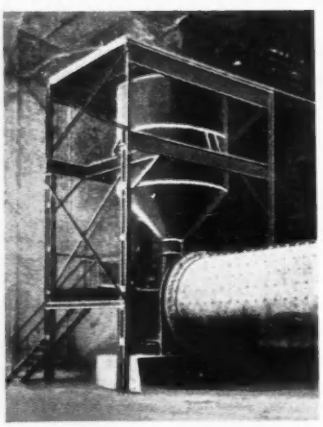

Fig. 1. Vertical hopper and mixing device for feeding the charge

hopper which feeds a conveyor belt. The exact proportion of iron pyrites, containing about 53 per cent. of sulphur, is led in from an automatic weigher, and the two materials meet in a vertical hopper equipped with a fine-mixing device. Thence the mixed mass enters the charging end of the rotary hearth, and slowly passes down the sloping length. What happens is that although most of the sulphur remains combined with the iron, the remainder attacks all metallic pellets and particles which may be present, whether they are represented by copper, iron, brass, or associated alloys. Theoretically, the total sulphur content of iron pyrites is 53.42 per cent., but the ferrous sulphide which remains, unless oxidising influences exist, amounts to 73.29 per cent., which only contains 36.45 per cent. of sulphur.

There is thus 26.71 per cent. of sulphur available to combine with the copper, which, as Cu_2S, contains 20.13 per cent., while the lead present contains 13.45 per cent. of sulphur. A larger margin of sulphur is added than would be required, which thus incorporates iron and any other metallic particles present, and still further increases the bulk by the formation of ferrous sulphide, which directly joins the matte. At the hopper end of the rotary hearth, the construction consists of riveted boiler plates, but further along the length welded bands are used to link up the different sections. The whole is mounted on rollers, which are either run on ball bearings, or oil-less bearings.

Where more than one rotary hearth is used, a pit is cut in the floor so that the molten matte may be directly tapped, while the loose waste mass falls down beneath the combustion chamber, thus affording still further opportunity for any remaining matte to separate out. A worm arrange is then used to thrust this latter hot mass on to freight cars which remove it to the waste dump.

With the foregoing process, no slagged material results,

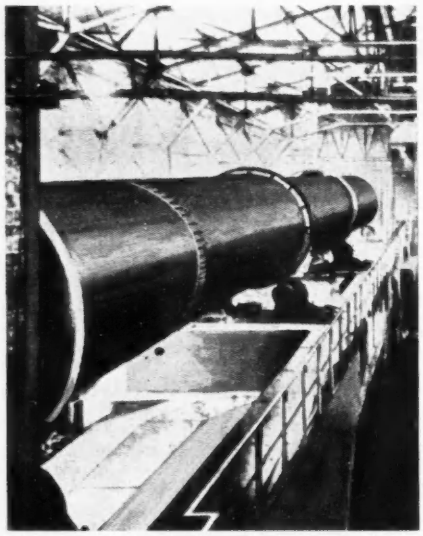

Fig. 2. Main body of the cylindrical hearth, which rotates continuously

and all metallic contents have been separated out in the form of a matte suitable for smelting by ordinary methods. When working with some fresh type of residues, it is customary to make an increased addition of pyrites, which, although giving more work in the subsequent refining, ensures the reclamation of all metal values. The final stages of converting the matte to copper alloy have not varied appreciably from the earlier method, but the speed and non-stop character of the improved process leave little to be desired. Its advantages over the system used during the last war, which in the intervening years saw little improvement, and in most cases was abandoned, will be appreciated. Instead of having waste residues, coal, and pyrites charged manually at intervals, leaving lengthy periods for the total mass to melt, and resulting in a vast accumulation of slag which could not be fully consumed for con-

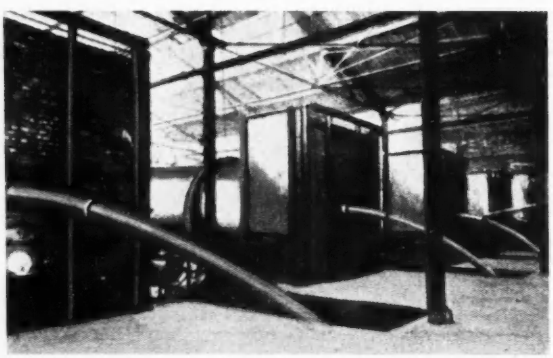

Fig. 3. Pulverised-coal burners and tapping pit

crete-block making, the rotary process is continuous, involves practically no labour, can handle a vast tonnage in a fraction of the time, and leaves behind no slagged mass. There is, in fact, practically nothing that can go wrong with the process, the small amount of sulphur oxides emitted obviates the need for a condenser system, while an improvised type of electrostatic apparatus is only rigged up to ensure the recovery of all tin present.

Copper Alloys

Economy Specification for Ingots and Castings

SPECIFICATIONS numbered B.S.1021 to 1028 for ingots and castings have just been issued by the British Standards Institution and provide for cast copper alloys in four different types. The present urgent need to economise in the consumption of virgin metals, and to utilise to the best advantage the supplies of bronze and brass scrap has required the preparation of new specifications. The purpose of these is to bring into use gunmetals and bronzes of lower tin contents than have been customary in Great Britain and to extend the use of cast brasses that can be made from scrap arising from machining operations and from other sources.

For the duration of the war it is proposed that the use of Admiralty Gunmetal of the 88/10/2 type (B.S.382 and 383) should be severely restricted, that leaded gunmetal of the 87/9/3/1 type (B.S.900 and 901) should not be used, and alternative alloys prepared as far as possible from scrap should be substituted. Since, however, scrap supplies will not suffice to produce all the gunmetal required it is proposed that when virgin metals have to be employed their use should be confined as far as possible to gunmetal of the 88/10/2 and 88/8/4 types. This will effect economy in the use of tin and, in addition, a high grade gunmetal will be available from the re-melting of any resultant scrap.

The use of a large variety of scrap involves the risk of producing alloys contaminated with a large number of elements. It has been realised that it is impracticable to specify limits for a large number of adventitious elements, but given the percentage of the main constituents of the alloys, it is considered that mechanical tests are a satisfactory check on the presence of impurities in harmful amounts. The preparation of a supply of ingots, made from scrap and of uniform composition, is, however, best ensured by melting in large quantities, and small foundries are advised to purchase ingots of guaranteed composition only from ingot manufacturers dealing in bulk.

The following alloys are provided in the series:—88/8/4, gunmetal; 86/7/5/2, gunmetal; 70-80, copper cast brass; and 62-70, copper cast brass; and suggested applications for these alloys are given in the foreword.

Copies of the above specifications (under one cover) may be obtained from the Institution, 28 Victoria Street, S.W.1, price 2s. 3d. post free.

COLD WORKED STAINLESS STEEL

Stainless steel can now be drawn and worked while cold, if first subjected to a simple chemical process which is the subject of U.S.P. No. 2,268,525 awarded to Gerhard Roesner, Ludwig Schuster, and Helmuth Ley of Frankfurt a.M., and assigned to the American Lurgi Corporation of New York City. Hitherto, the inventors declare, before stainless steel could be drawn or worked it was necessary to heat the metal. The cost of fuel and equipment involved added to the expense in the manufacture of stainless steel articles. Such heating is eliminated by the newly patented process. The steel is mainly dipped into a solution of hydrochloric acid and ferric acetate. After remaining in the bath for twenty minutes it may be cold-drawn or worked while cold into any desired shape.

POROUS IRON BEARINGS

A new line of porous bearings which are interchangeable with comparable bronze bearings, in most applications, has been introduced by the Keystone Carbon Co., of St. Marys, Pensylvania, who claim that these bearings are stronger than the similar bronze articles, moulded from powdered iron, the bearings are baked and finally saturated with lubricating oil. They hold sufficient oil to last, in many cases, for the entire life of the application. A low coefficient of friction, combined with self-lubrication, is said to prevent excessive temperature, speed reduction, noise, and scoring of shafts.

De-Tinning Cans

Practical Process in Operation

A PROCESS for recovering tin and steel from used tin cans, requiring no preparation of the cans on the part of the householder or other users of canned commodities, can now be applied to large-scale production, according to an announcement by the Metal & Thermit Corp., 120 Broadway, New York. This company has been operating a test plant at San Francisco for the past five years. The pilot plant is a complete unit with a capacity of over 6000 tons. From its operations, suitable methods have been worked out, according to *Chemical and Engineering News*, for the recovery of about 24 lb. of tin oxide and almost a ton of scrap steel per ton of discarded cans. The tin oxide is readily smelted to a grade equivalent to Straits tin, the grade formerly secured from the Malay Peninsula.

The processing unit comprises unloading equipment, inspection station, rotary screens for dirt removal, incinerator for charring cans to destroy fat, paper, lacquer, and other combustibles and to separate the carbonaceous residue, shredding and pre-washing equipment, storage facilities, and complete equipment for continuous detinning by the alkali process.

Rough estimates indicate that about 1,000,000 tons per annum of discarded tin cans could be economically collected and detinned, yielding about 11,000 tons of tin and 900,000 tons of scrap steel. Detinning of tin plate clippings obtained from canning companies and other sources has been a well-established industry for more than 30 years, but detinning of used cans has so far proved uneconomic in peace time. The principal problems involved are those of collection, preparation, and transport of cans.

Mexican Metal Production

Output to be Raised by U.S. Aid

AN agreement between the Mexican Government and the Metals Reserve Company of the United States, designed to increase the Mexican output of copper, lead and zinc, is reported to be approaching completion. It is understood that the programme calls for the expenditure of about $100 million on mine development and the improvement of transport facilities.

In addition the Metals Reserve Company is expected to offer a more attractive price to base-metal producers in order to encourage the maximum output. Purchases are expected to include 75,000 tons of copper, 250,000 tons of lead and 200,000 tons of zinc. In 1941 Mexican production of copper amounted to 48,700 tons, of lead to 155,300 tons, and of zinc to 155,000 tons. During the current year these totals are expected to be considerably exceeded. Production of antimony and arsenic in Mexico would probably also be considerably extended.

MICRO-DETERMINATION OF MAGNESIUM

At a meeting of the Society of Public Analysts last month, held in the Chemical Society's rooms at Burlington House, a paper on the gravimetric micro-determination of magnesium was presented by Dr. P. F. Holt. Benedetti-Pichler's method for the gravimetric micro-determination of magnesium, in which the metal is precipitated and weighed as $MgNH_4PO_4,6H_2O$, was found to give results which varied according to the time allowed for precipitation. Consistent but high results were obtained if the precipitate was allowed to stand in contact with the mother-liquor for several hours. A precipitation time of one hour or less gave values which were irregular, but approximated to that calculated from the formula. Good values are obtained by this method if five hours are allowed for precipitation and an empirical factor is used for conversion of precipitation weight to weight of magnesium.

Schlesische Chemie A.G. is a new company formed at Breslau (Silesia), with a capital of 600,000 marks, for the manufacture of sulphuric acid, aluminium sulphate, cement and by-products.

Spectrography for Tin

Analysis of Commercial Metal Samples

THE National Bureau of Standards in America analyses samples of pig tin, tin pipe, tin-lined fittings, and fusible plugs for deleterious impurities under governmental specifications. Certain impurities seriously impair the effectiveness of tin products in use. For example, zinc or iron in amounts less than 1 per cent., or other elements in larger quantities, may raise the melting point of a fusible plug above the safety limit. Moreover, much reclaimed tin is finding its way back into use, adding to the importance of access to rapid and reliable analytical methods. The wet-chemical analysis of tin is difficult and tedious when small amounts of impurities are involved. Bourdon F. Scribner of the Bureau's Spectroscopy Section, therefore, investigated the practicability of substituting a spectrographic method of analysis. A satisfactory method is described in detail in the February *Journal of Research* (RP 1451).

Measurement of Impurity Lines

The tin is fabricated into electrode rods for spark excitation by melting and chill-casting where mixing of the sample is required, or by compressing millings or turnings of the sample under high pressure. The light from the spark between the tin electrodes illuminates a spectrograph which provides a photographic record of the spectrum. The intensities of selected impurity lines are measured in relation to control lines of the tin spectrum by means of a photocell and galvanometer, incorporated in a microphotometer. The change of impurity-line intensity with concentration is measured for a series of samples of known composition, and a curve is drawn relating these quantities. The analysis of an unknown sample is made by measuring line intensities in the same manner and then reading the concentration from the analytical curve. The method permits determination of ten impurities: antimony, arsenic, bismuth, cadmium, copper, indium, iron, lead, silver, and zinc. The error is usually of the order of ± 5 per cent. of the amount present, and may be decreased to ± 2 per cent. by close control.

The time required for the necessary determinations on 6 samples is 2 hours, as compared with 2 days for the equivalent routine wet-chemical analysis. Other advantages of the spectrographic method lie in the use of small samples and the certainty of detection of uncommon impurities. The spectrographic method has replaced the routine wet-chemical method at the Bureau for the analysis of tin of commercial grades.

Elastic Properties of Alloy Irons

Comparison with Plain Irons

A KNOWLEDGE of the elastic properties of cast iron is important in connection with the design of structural parts, such as piston rings, cylinder liners, etc. This is particularly true at the present time when emergency conditions have greatly increased its use. Therefore, A. I. Krynitsky and C. M. Saeger, jr., of the U.S. National Bureau of Standards, have extended their previous study of elastic properties to include three types of alloy cast iron. Test bars 1.2 inches in diameter and 21 inches long were made and tested for transverse strength, deflection, Brinell hardness, and microstructure. The metal was melted in a high-frequency induction furnace of the tilting type. It was heated before casting to the maximum temperatures of 1400 °, 1500°, 1600° and 1700° C. Test bars were vertically cast, bottom poured in green sand moulds at a temperature 100°, 150°, 200° and 250° above the liquidus.

As reported in the *Journal of Research* for January (RP 1447), a comparison of the results for alloy irons with those of plain carbon irons examined previously indicates that the relative modulus of elasticity of some carbon irons is higher than those of the alloy irons investigated. The benefical effect of the maximum heating temperature on the moduli of rupture and elasticity was more pronounced for the plain carbon irons than for alloy irons. The effect of pouring temperature for both plain carbon and alloy irons was about the same, *i.e.*, these properties showed a tendency to increase with a decrease in pouring temperature.

Hardening Forging Steels

The Effect of Complex Deoxidisers

IT has been reported that the toughness of forging steels can be improved by use of complex deoxidisers containing titanium, aluminium, and vanadium. In the light of these results, an investigation of similar deoxidisers containing various hardening and grain-refining elements has been reported by G. F. Comstock, Titanium Alloy Mfg. Co., Niagara Falls, N.Y., to the American Institute of Mining and Metallurgical Engineers.

These deoxidisers included three manganese-silicon-aluminium-titanium alloys with and without boron and calcium, three titanium-aluminium ferroalloys with vanadium, molybdenum, and zirconium respectively, and aluminium-zirconium ferroalloy and plain ferroboron.

Incorporation of minute amounts of boron in fine-grained 0.40 per cent. carbon steels is surprisingly effective in increasing hardenability. Small boron additions also gave good ductility and superior toughness, with high strength, after hardening and drawing at low temperatures such as 230° to 340° C. When drawn at higher temperatures to hardness values below about 45 Rockwell C, the superiority and toughness of steel so treated over steel similarly treated, but without boron, disappears. The amount of boron that should be present in these 0.40 per cent. carbon steels appears to be about 0.002-0.007 per cent. To secure a superior combination of strength and ductility, together with high hardenability in fine-grain steel of this nature, it is advantageous to add the boron in the form of a complex titanium alloy rather than as ferroboron.

Tin Research Report

Utilisation of Available Tin Supplies

IN the Tin Research Institute's Report for 1941 it is stated that since Japan began the Far Eastern campaign the main tin problem has resolved itself into making the best use of supplies available, by curtailing the use of the metal in commodities not essential to the war effort, by improving the processes in essential uses, and by recovering tin. For these tasks, the experience accumulated by the Institute is invaluable, and it has been appointed by the Ministry of Supply to advise on all technical questions affecting the use of tin.

During 1941 the major efforts of the Tin Research Institute were concentrated on war problems, on which it is not possible to report in detail. The Institute has assisted the Ministries of Food and Supply in finding a substitute for the cereal products used to remove palm oil from freshly made tinplates. The use of flax shives, either alone or mixed with wood flour or sawdust, has been adopted. Progress has been made in developing a substitute for the palm oil, which is now in short supply.

The Institute's hot-tinning plant was in continuous operation throughout the year, and much assistance was rendered to manufacturers in tinning some kinds of steel which have hitherto been difficult to tin. Collaboration with manufacturers and with Government departments in the application of electro-tinning for parts of armaments was continued during the year, and there has also been considerable interest in electro-tinning for small soldering tags, terminals, and clips. Although not dealt with in the report, the most important application of this work will soon be seen in the production of specially thinly coated tinplates, as a war economy measure, requiring only one-third of the tin used on normal tinplate. Other sections review the progress made in research on tin-rich bearing alloys, foil, and bronzes. Copies of the report may be obtained free of charge from the Tin Research Institute, Fraser Road, Greenford, Middlesex.

General News——From Week to Week

A new life of Lavoisier, entitled "Torch and Crucible," by Sidney J. French, has been published by the Princeton University Press, and is obtainable in this country through the Oxford University Press, price 16s.

London Transport intends to convert 20 buses from petrol burning to producer-gas operation in the immediate future, and a demonstration bus has already been on view in London. Activated anthracite is the fuel used for producing the gas, and when all buses suitable for alteration have been converted, a saving of 7,000,000 gallons of petrol per annum will be effected.

The report of the Substitute Fuels Committee, which is under the chairmanship of Lord Henley, is not to be made public, according to a statement made by the Secretary for Mines, in the House of Commons, on Tuesday. In answer to a question by Mr. Craven-Ellis, he further stated the publication was "not deemed to be entirely necessary and in the public interest."

A simple specification (B.S.1013, price 2s. 3d. post free) for disinfectant powders has been issued by the British Standards Institution, in order to satisfy the general requirements of buyer and seller. Applied to carbolic and other powders, it covers fineness, germicidal efficiency, and phenols content, and its two appendices contain a sieving test and a method for the determination of tar acid.

Oleos Lubrificantes, Ltda., Soc. de. Ave. Joao Crisostomo 72, Lisbon, and Rua de Santo André, Braga, is one of nearly 500 firms in neutral countries with whom trading of any kind is illegal. It is included in the Trading with the Enemy (Specified Persons) (Amendment) (No. 8) Order 1942 (S.R. & O. 1942, No. 912), price 3d. Deletions number 47, and Part III of this Order includes address alterations of several firms previously noted.

At the annual general meeting of the Institute of Physics, held in London on May 28, the following were elected to take office on October 1, 1942: President, Professor Sir Lawrence Bragg; vice-presidents, Dr. W. Makower and Mr. T. Smith; hon. treasurer, Major C. E. S. Phillips; hon. secretary, Professor J. A. Crowther; ordinary members of the board, Professor J. Chadwick, Professor J. D. Cockcroft, Mr. D. C. Gall, and Mr. E. B. Wedmore. In his presidential address, Sir Lawrence Bragg spoke of the need for a more practical basis in the future training of physicists, and stated that the Planning Committee of the Institute had this question in hand, as well as the immediate necessity for the supply of trained physicists for wartime purposes.

Foreign News

The export of beeswax from Argentina is now subject to permit, which will be granted only when the needs of the internal market have been satisfied.

Tanning extracts obtained from Norwegian cellulose works are being used instead of imported tanning materials, and are said to prove satisfactory for ox and cow hides.

The Argentine Government has set up a sub-committee, known as the Comisión de Distribución del Cancho, for the purpose of dealing with all matters relating to the distribution of rubber supplies, reclaiming old rubber, etc.

The production of fluorspar on a small scale has been undertaken by A/B Branteviks Gruvor, a Swedish company formed recently. It is reported that the material may be used in the manufacture of light metals at Sundsvall.

Prospecting for oil shale in Australia has led to the location of an extensive low-grade shale basin at Plevna, Queensland, about 60 acres in surface extent. The crude-oil yield indicated is a little over 20 gallons per ton, which compares with Scottish oil shales at 21/22 gal. per ton.

An asbestos material is now being produced by the Germans in Norway, where small deposits of serpentine have been known to exist for a long time. A small production of asbestos was reported before the war from Finland, Italy, and Czechoslovakia, but the supply from these sources cannot cover all German needs.

A mica deposit in the Prilep district of Macedonia, which was hitherto worked by primitive methods, is to be developed with the help of modern plant supplied by Germany, and it is stated that a German firm is financially interested in the scheme. Some 1500 workers are to be employed.

Production is due to start very shortly at the second paper factory and at the new cellulose plant which were completed at Izmit (Turkey) at the beginning of this year. Water for these factories is supplied from the Sabandja Lake. Investigations have shown that pulp from domestic white-pine forests is suitable for replacing the pulp formerly imported from Russia.

Expansion in the production of copra products in Trinidad (and to a lesser extent in Barbados and British Guiana) has led to an increased demand for wooden lard pails and other wood containers to take the place of the tins usually employed in packing edible oil and lard. Processing materials are also in demand, such as stearine, caustic soda and potash, refined salt, and fullers' earth.

Canada's export trade for the March quarter of 1942 totalled $492,521,000, against $288,437,000, in the same quarter of 1941, according to the Dominion Bureau of Statistics. Important increases (figures in $1000) were: to the U.K., 185,616, against 127,007; U.S., 169,131 (106,547); British India, 27,508 (7489); Egypt, 40,020 (3211); Australia, 11,203 (5315); U.S.S.R. 10,209 (2).

The use of superpolyamides for shoes is under development in Germany, where I.G. has carried out extensive experiments. Material of the "Igamid" type (see THE CHEMICAL AGE, May 2, page 230), has been proposed for use instead of bend leather and for rubber-like soles. Some grades of the material are said to have a general strength superior to sleeked leather, and they can also be sewn. The use of "Igamid" in the place of leather soles is stated to be under preparation.

The Sharon Steel Corporation of the United States has developed a new process for electroplating tin on steel sheets, strip and wire which, according to John S. Nachtman, director of research, saves from 40 to 50 per cent. in pig tin. The steel material is first given a "flash" coating of a metal other than tin, whereupon tin is deposited and brightened by melting. It is claimed that this tin coating is more resistant to rusting than hot-dipped tin plate.

A new board of four managing directors has been appointed for the General Aniline and Film Corporation by the U.S. Treasury Department, an important step towards Government control of foreign-owned property. Mr. R. E. McConnell, the new president, is a distinguished mining engineer; the vice-president, Mr. A. E. Marshall, is well known as a chemical engineer, as is Mr. R. E. Wilson, the third director. Mr. J. M. Moffett, the remaining director, has been associated with the corn-products refining industry.

Forthcoming Events

On **June 8,** at 5.30 p.m., the **Electrodepositors' Technical Society** will meet at the Northampton Polytechnic, E.C.1, when a paper will be presented by Mr. A. Ensor on "The Brytal Process for the Anodic Oxidation of Aluminium." This will be the last London meeting of the current session.

The 79th annual general meeting of **The Institution of Gas Engineers** will be held in London at 10 a.m. on **June 10.** At 10.25 the presidential address will be delivered by Sir Frederick J. West, chairman and managing director, West's Gas Improvement Company, Limited, Manchester, and at 11 a.m. short papers on "The Gas Industry: Further Considerations on Efficiency and Development," will be presented and discussed. The discussion will be continued after luncheon.

The Institute of Chemistry announces that the second presentation of the lecture on "Recent Advances in Photographic Theory," given by Dr. H. Baines, will take place in the Chemistry Lecture Theatre of the West Ham Municipal College, Romford Road, London, E.15, at 6 p.m., on **June 17.**

Commercial Intelligence

The following are taken from printed reports, but we cannot be responsible for errors that may occur.

Mortgages and Charges

(Note.—The Companies Consolidation Act of 1908 provides that every Mortgage or Charge, as described therein, shall be registered within 21 days after its creation, otherwise it shall be void against the liquidator and any creditor. The Act also provides that every company shall, in making its Annual Summary, specify the total amount of debt due from the company in respect of all Mortgages or Charges. The following Mortgages and Charges have been so registered. In each case the total debt, as specified in the last available Annual Summary, is also given—marked with an *—followed by the date of the Summary, but such total may have been reduced.)

LANGLEY ALLOYS, LTD., Bucks. (M., 6/6/42.)—May 6, mort., to Swiss Bank Corporation securing £2570 10s. 4d. and any further advances; charged on certain machines, etc. *£70,000 floating charge and £3102 mortgages on certain plant. March 16, 1942.

Companies Winding-Up Voluntarily

REDUCIBLE COMPOUNDS, LTD (C.W.U.V., 6/6/42.)—By special resolution May 14. Leslie Clarence Montague, 78 Hatton Garden, London, E.C.1, appointed liquidator.

WHITE'S LABORATORIES, LTD (C.W.U.V., 6/6/42.)—By special resolution, May 27. Ronald George Leach, 29 Arthur Road, S.W.19, appointed liquidator.

Company News

Watford Chemical Company, Ltd., 11 Waterloo Place, S.W.1, have increased their nominal capital beyond the registered capital of £1000, by the addition to £9000 in £1 ordinary shares.

The Eaglescliffe Chemical Co., Ltd., report a profit for 1941 of £7323 (£4580), and have declared a dividend of 5 per cent. on the ordinary shares (nil).

The British Oil and Cake Mills, Ltd. (an associate of Lever Brothers and Unilever, Ltd., who hold all the ordinary stock), report profits for 1941 of £578,296 (£745,373), and announce an ordinary dividend of 5 per cent. (9 per cent.).

The British Oxyygen Company, Ltd., announce dividends on the 6½ per cent. cumulative preference and 5 per cent. cumulative second preference shares, less tax, at 9s. 6d. for the half-year to June 30, 1942.

New Companies Registered

Chegwyn-Rawson Research Laboratories, Ltd. (374,164).—Private company. Capital: £1500 in 1500 shares of £1 each. Research, consulting and analytical chemists, manufacturers of and dealers in chemicals, disinfectants, laboratory reagents, etc. Subscribers: Mrs. W. V. Raby; Mrs. D. B. Brooke. Registered office: 105 Station Road, Edgware, Middlesex.

Chemical and Allied Stocks and Shares

CHEERFUL conditions have developed in the stock and share markets in response to satisfaction with the war news. Although improvement in the volume of business was only moderate, the upward trend in values has been fairly widespread at the time of writing, due partly to the fact that many securities are very firmly held and in short supply. The better prices have been followed by very little selling. It is generally realised that the trend of markets will continue to move closely with the nature of the war news from time to time; but in many quarters the prevailing view is that, over a period, there is likely to be a strong rise in all classes of securities and a general trend to lower yields. Dividend announcements and financial results that have come to hand have continued to create a satisfactory impression, particularly the maintenance of the "Shell" dividend at 5 per cent., tax free.

Turner & Newall were good, having further improved to 70s. while awaiting the dividend announcement; Boots Drug rallied further to 35s. 9d., and units of the Distillers Co. remained firm, at 75s. 9d., on continued expectations in the market that the dividend is likely to be kept on a 16⅔ per cent. basis. Imperial Chemical at 33s. 7½d. were slightly higher, and the 7 per cent. preference were quoted at 34s. 9d. Lever & Unilever were also better at 25s. 9d., on satisfaction with the results of subsidiary and associated companies which have come to hand recently. Borax Consolidated were again firm and unchanged at 31s. Imperial Smelting at 10s. 6d. continued to hold their recent improvement. There was a further rise in Dunlop Rubber to 28s. 6d., on consideration of the full report for the past year's working. In other directions B. Laporte were again firmly held around 64s., it being pointed out that the 15 per cent. dividend for the past year was a conservative payment. Firmness was also shown by British Oxygen at 67s. 6d., and by British Aluminium at 43s. 9d., while Pinchin Johnson further improved to 25s. 6d., and Wall Paper Manufacturers deferred units were 25s.

General Refractories continued to hold their recent rally to 9s. 4½d., and Goodlass Wall, which remained under the influence of the maintained dividend, were again 8s. 9d. Elsewhere, Associated Cement reflected the better market trend with an improvement to 50s., while there was once more activity in British Plaster Board around 22s., awaiting the dividend announcement. British Industrial Plastics 2s. shares were again active around 4s. 1½d.; Lacrinoid Products 2s. shares changed hands up to 3s. 3d.; and there were dealings in a number of other shares of companies associated with the plastics industry. Bradford Dyers, Calico Printers, and various other textile shares moved better; and there was further improvement in British Celanese ordinary shares to 9s. 6d. The market is continuing to talk of the possibility that arrears of second preference dividend may be dealt with by the last-named company by means of a funding scheme.

Monsanto Chemicals preference shares were again 22s. 6d., and Greeff-Chemicals Holdings 5s. ordinary were around 5s. 7d. Triplex Glass 10s. units fluctuated and are 30s. 4½d. at the time of writing; the market remains hopeful that the dividend for the financial year ending this month may be raised to 15 per cent., an increase of 5 per cent.; but it is realised that these hopes are probably already fairly well discounted in the current price. Among iron and steel issues, Stewarts & Lloyds were 46s. 3d., and Dorman Long 15s. 6d., but United Steel eased slightly to 22s.

United Glass Bottle shares remained firm at 55s., and Forster's Glass 10s. ordinary were again around 18s. 9d. Results of the last-named company are due shortly. Morgan Crucible first and second preference shares continued to hold their recent gains and were firmly held. Oil shares showed various strong gains under the lead of "Shell" which reflected satisfaction with the maintained dividend. The Prime Minister's statement regarding the Libyan campaign assisted sentiment in regard to Anglo-Iranian shares.

British Chemical Prices

Market Reports

CONDITIONS in the general chemicals market are reported as steady with deliveries against existing contracts proceeding along satisfactory lines. No important price changes have been reported during the past week and values throughout the market display a very firm undertone. In both the soda and potash sections the movement has been on a good scale with offers of chlorate of soda and yellow prussiate of soda and the majority of the potash products insufficient to meet current requirements. The demand for oxalic acid, tartaric acid, and citric acid remains strong and elsewhere the position of the lead oxides, arsenic, and the barium compounds continues steady. The increasing number of restrictions in the coal-tar products market has made new business difficult to negotiate. Creosote oil and crude and crystal carbolic acid are being steadily absorbed, while interest in the pyridines and xylols is quiet. The demand for cresylic acid remains good with existing commitments receiving the chief attention.

MANCHESTER.—After the slight interference with operations on the Manchester chemical market last week as a consequence of holiday interruptions at some of the consuming works, trading conditions are now pretty well normal. Deliveries of a wide variety of materials for the textile bleaching, dyeing, and finishing trades are being taken up on a fair scale, and other classes of chemicals are in steady demand. On the whole, values are much the same as before. Most of the light and heavy tar products are being taken up in good quantities against contracts, with a moderate volume of new business placed.

GLASGOW.—Business in the Scottish heavy chemical trade has been rather quieter during the past week both for home and export trades. Prices maintain their very firm position.

Price Changes

Linseed Oil.—Crude, £46 10s. per ton, naked ex works.
Pitch.—MANCHESTER: 44s. per ton at works.
Rapeseed Oil.—Crude, £48 5s. per ton, naked ex works.

TAR DISTILLERS' RESEARCH

At a general meeting of the Association of Tar Distillers held on May 20, the newly elected president, Mr. C. E. Carey, of the South Metropolitan Gas Co., took the chair and addressed the meeting on the basic problems confronting the industry. He drew especial attention to the need for long-range research in new products from coal tar, and appropriate organisation, by the industry itself, to meet the fluctuating market and financial conditions which might be expected. Shortage of bitumen has stimulated inquiry for special tar products, particularly in the soft pitch range, for such purposes as saturants for roofing felts, waterproof membranes, paints, etc. Many tar distillers have produced suitable materials in the past, and steps are being taken by the industry to co-ordinate the experience of these firms in making available a range of products to assist consumers in the present shortage of bitumen for such purposes. The association is already co-operating with other interests, under the ægis of the B.S.I., in work on a specification for coal tar pitch for roofing felts.

The Banco do Brasil has been authorised by the Government to grant a loan of 69,000 contos to the Cia. Brasileira de Alumínio. This company has been formed in Sao Paulo with a capital of 60,000 contos, to develop the bauxite deposits at Poços de Caldas in the State of Minas Geraes, and eventually to manufacture aluminium. It was stated that the U.S.A. authorities had agreed to concede priority for the supply of materials and equipment for the new plant.

The third largest potash combine in Germany, Burbach Kaliwerke A.G., reports that deliveries of potash and of rock and brine salts in 1941 were approximately the same as in the preceding year, while the sales of other by-products (magnesium salts, bromine) increased. Plant mechanisation was continued, but an early completion of this development is not envisaged. Total sales rose from 17.43 to 21.29 million marks. The dividend is maintained at 4 per cent. for the increased capital of 27 (18) million marks.

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